

Annealing Effect on the Structural and Optical Properties of In₂S₃ Thin Films

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Indium sulfide thin films have been grown onto glass substrates using radio frequency magnetron sputtering at room temperature. The as-deposited film were annealed in nitrogen atmosphere at different temperatures of 100, 200, 300, 400 and 500°C with an 1 h annealing time. The effect of annealing temperature on composition, structure, morphology and optical properties of the as-grown In₂S₃ films has been studied. The XRD results indicate that the as-deposited films are composed by a mixture of both cubic α and β crystalline phases, with some fraction of tetragonal phase. The thermal annealing on the films produces the conversion of the cubic crystalline phases to the tetragonal β one and a crystalline reorientation of the latter phase. The surface morphological analysis reveals that the films grown at 300°C have an average grain size of ~ 58 nm. These films show a S/In ratio of 0.99. The optical band gap is found to be direct and the films grown at 300°C shows a higher optical transmittance of 80% and an energy band gap of 2.52 eV.

Keywords: In₂S₃ thin film, Cd-free buffer layer, Solar cell, Sputtering